

Ecovision for a Green Growth: Towards a Renewable Energy Future

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Abstract—*Ecovision is an ecological vision, an aspect of development for a sustainable future. It deals with planning through innovative aspects for conservation of resources. Our planet's threshold limit is overstretched as wasteful resource methods of production and consumption have been taking its toll, on the planet, and the people living on it. Moreover it can provide a pathway for sustainable renewable energy in future through urban and rural initiatives leading to climate change.*

Furthermore green growth is becoming imperative. The magnitude of the problem of environmental sustainability is laid bare by organizations such as World Bank's Sustainable Development Goal 7, which wants to ensure secure sustainable energy, UN Sustainable Development Solutions Network, which has been mobilizing scientific and technical expertise for problem-solving in relation to sustainable development, UNESCAP's (United Nations Economic and Social Commission for Asia and the Pacific) online portal providing unprecedented access to information on the energy policies which advances the sustainable energy agenda.

Environmental problems that we face today require long-term potential actions for sustainable development. Sustainable Energy is a key enabler of sustainable development for all countries and all people. Major changes in the current trends are required so that future energy systems are affordable, clean, safe, secure, and environmentally sound ultimately eradicating poverty. In this regard, renewable technologies are considered as clean sources of energy and optimal use of these resources will minimize environmental impacts, produce minimum secondary wastes and are sustainable.

This article looks into the renewable energy scenario in the world and increasing energy consumption of different regions of the world, to emphasize the importance of alternate sources of energy, strategies and plans for a sustainable future. Besides this, an account of ecological vision for sustainable renewable energy in terms of its eco-efficiency and climate change scenario has been demonstrated.

Keywords: *ecovision; eco-efficiency; renewable energy; environment; sustainable future.*

1. INTRODUCTION

Ecological vision is becoming a necessity for nations, with a mission to develop in an ecologically sustainable manner. World bodies and countries are forming plans and strategies to develop in an ecological manner. The World Bank has Sustainable Development Goals (SDG) at the heart of development, with Goal 7 devoted to secure sustainable energy.

Global climate change, its present control and even its future reduction have been considered. Energy has been proposed as the main feed of comprehensive development. The way for meeting energy needs which certainly affects the existing energy resources will have forceful climate consequences [1]. Many countries have become aware of the stark realities due to climate change and are forming plans with conservation of resources at the core of it. Therefore renewable energy alternatives are gaining importance. Ecological vision towards renewable energy possibilities is gaining ground and many pilot projects have also come up.

Population and the economic growth are highly correlated with the energy demand which is further expected to increase in the near future. However, about 85–90 % of the energy demand is supplied by petroleum, natural gas, and coal, even though they are harmful for the environment and estimated to be depleted soon [2]. The purpose of this article is to give visionary outlook to curtail increasing energy consumption since energy consumption is on the rise in different regions of the world, leading to climate change.

2. SUSTAINABLE DEVELOPMENT

The concept of 'environmental sustainability', reposes on a fundamental principle: *meeting human needs without undermining the capacity of the planet's ability to support life*[3]. Environmental sustainability forms one of the three integrated dimensions of 'sustainable development', alongside the economic and social dimensions. Far from being only about the preservation of natural resources, environmental sustainability is fundamental to poverty reduction, human development and well-being.

The UN System Task Team (UNTT), the High-Level Panel and the Sustainable Development Solutions Network recognized environmental sustainability to be essential element of sustainable development leading to end poverty[4-8]. The United Nations General Assembly's special event to track up on exertions made towards achieving the Millennium Development Goals emphasized the *intrinsic interlinkage* between poverty eradication and the promotion of sustainable development, while underlining the need *for a coherent approach that integrates in a balanced manner the*

three dimensions of sustainable development in the post-2015 agenda [9].

Moreover, partnerships to channel related commitments and actions from a wide set of actors along with the active engagement of individuals and communities at the grassroots levels must be seen as fundamental to any development action undertaken. During the United Nations-led post-2015 consultation on environmental sustainability, which engaged over 5,000 stakeholders from around the world, there was widespread consensus that local action is essential to securing environmental sustainability and that local community groups can indeed deliver *a wide range of benefits for people and nature if empowered to manage their ecosystems and natural resources*[10]. The emphasis on such an approach is fitting for a new development framework that seeks to be *grounded in the voice of people* [11]. Local participation and civic engagement, if well supported and facilitated, can be a vital aspect of long-term social transformation and empowerment.

3. CLIMATE CHANGE SCENARIO

Twenty-first century came with a primary alarm of climate change [12]. It affects health through a range of corridors, for example as a result of increased frequency and intensity of heat waves, reduction in cold related deaths, increased floods and droughts, changes in the distribution of vector-borne diseases and effects on the risk of disasters and malnutrition. The overall balance of effects on health is likely to be negative and populations in low income countries are likely to be particularly exposed to the adverse effects. The experience of the 2003 heat wave in Europe showed that developed countries may also be adversely affected [13].

The potentially most important ecological problem relating to energy is global climate change (via global warming or the greenhouse effect). The increasing concentration of greenhouse gases such as CO₂, CH₄, CFCs, halons, N₂O, ozone, and PAN (peroxyacetylnitrate) in the atmosphere are components which trap heat radiated from Earth's surface and indeed raising the surface temperature of Earth [14]. Numerous scientific reports reveal that overall CO₂ levels have increased 31% in the past 200 years. Moreover since 1800, 20 Gt (gigatonnes) of carbon is being added to environment only due to deforestation and the concentration of methane gas which is doubled, is responsible for ozone layer depletion. The global mean surface temperature has increased by 0.4–0.8°C in the last century above the baseline of 14°C leading to increase global mean sea levels at an average annual rate of 1–2mm. Arctic sea ice is thinned by 40% and decreased in extent by 10–15% in summer since the 1950s [15]. Industry contributes directly and indirectly (through electricity consumption) about 37% of the global greenhouse gas emissions, of which over 80% is from energy use. Since 1971, total energy-related emissions have grown by 65%, which were 9.9 Gt CO₂ in 2004[16]. There is ample scope to minimize emission of

greenhouse gases if efficient utilization of renewable energy sources in actual energy meeting route is encouraged[17].

4. GLOBAL ENERGY CONSUMPTION STATISTICS

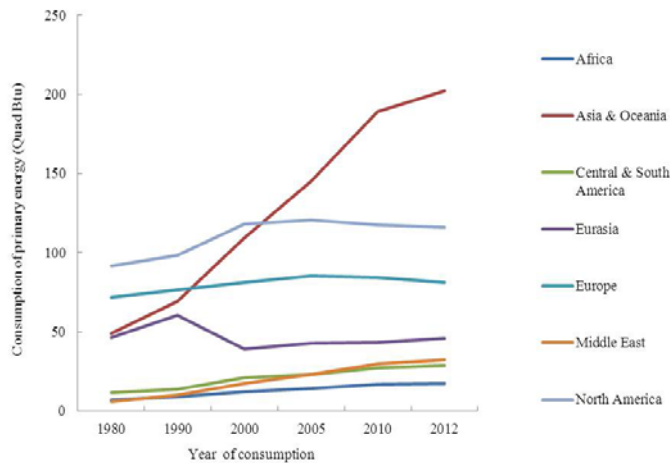
Population and the economic growth are highly interconnected with the energy mandate. The world population was multiplied by a factor of 1.59 (reaching above 7 billion) from 1980 to 2013, while the total energy consumption of the world was multiplied by 1.84 (getting beyond 155,000 TWh) in the same time interval of 33 years. The demand for energy is expected to proliferate even more with an average annual rate of 1.2 % in the near future. However, for the last 30 years, about 85–90 % of the energy demand is provided by petroleum, natural gas, and coal, even though they are harmful for the environment and estimated to be depleted soon[2].

4.1 Primary energy consumption

As is evident from the table 1 and graph 1, the energy consumption has been rising and has quadrupled for the fast developing region of Asia and Oceania since 1980. For the entire world energy consumption has almost doubled which is ominous for the planet. The European and North American regions have nations with highest per capita energy consumption which is on the rise, though they faced a slight downturn in the 2009 global financial crisis. (In 2009 primary energy consumption had decreased in US to 114.63 quad btu and Europe it decreased to 80.89 quad btu). European region has nations which are trying hard with Germany foraying into renewable energy consumption and it can be seen in the statistics that there has been stability in the energy consumption in Europe over the last few years and even a slight decline.

Table 1: Primary energy consumption [18]

Consumption of Primary Energy (Quad Btu)						
Regions	Year					
	1980	1990	2000	2005	2010	2012
Africa	6.8	9.33	12.041	14.48	16.73	17.34
Asia & Oceania	48.92	69.17	109.55	145.09	189.16	202.12
Central & South America	11.53	13.72	20.81	23.39	27.13	28.67
Eurasia	46.74	60.76	39.09	42.73	43.43	46.09
Europe	71.72	76.43	81.21	85.43	84.14	81.45
Middle East	5.84	10.35	17.34	23.22	29.73	32.21
North America	91.6	98.32	118.23	120.82	117.80	116.19
World	283.14	338.09	398.27	455.14	508.13	524.07



Graph 1: Trend of energy consumption

4.2 Per capita energy consumption

Per capita Energy consumption (kilograms oil equivalent) for 2010 is collected from the UN Data. As is depicted in the table 2, per capita energy consumption is on the rise in developing countries and is very high among the developed countries.

5. SIGNIFICANCE OF SUSTAINABLE RENEWABLE ENERGY

5.1 Renewable Energy Sources for the future

Renewable energy sources (RES) will play an important role in the world's future. Renewable energy sources are those resources which can be used to produce energy again and again, e.g. solar energy, wind energy, biomass energy, geothermal energy, etc and are also often called alternative sources of energy or inexhaustible energy resources [20]. Main renewable energy sources and their usage forms are given in Table 3.

For the last 30 years, about 85–90 % of the energy demand is supplied by petroleum, natural gas, and coal, even though they are harmful for the environment and estimated to be depleted soon [22]. Renewable energy sources (RES) supply 14% of the total world energy demand [22]. Large-scale hydropower supplies 20 percent of global electricity but wind power in coastal and other windy regions is promising source of energy [22, 23]. The share of RESs is expected to increase very significantly (30–80% in 2100) [23]. Other 'new' and emerging RE technologies such as geothermal and biofuel supply 2% of the world's primary energy needs [24]. Renewable Energy creates manifold public assistances such as [25]: environmental improvement (reduction of power plant greenhouse emissions, thermal and sound pollution); increased fuel diversity; reduction of energy price volatility effects on the economy; national economic security (fossil energy is vulnerable to political instabilities, trade disputes, embargoes and other disruptions); increase in economic productivity and increase in gross domestic product (GDP) through more efficient production processes.

Table 2: Per capita Energy consumption of some of the countries [19]

Countries	Per capita Energy consumption (kilograms oil equivalent) for 2010
Norway	6195.0
USA	6501.0
Singapore	4049.0
Korea	3809.0
Germany	3260.0
Japan	3177.0
UK	3143.0
Denmark	2848.0
France	2820.0
Malaysia	2486.0
Switzerland	2459.0
South Africa	2452.0
China	1534.0
Mexico	1442.0
Brazil	930.0
Indonesia	543.0
India	440.0

Renewable energy system development will make it possible to resolve the crises of energy all over the world. Crucial tasks like improving energy supply reliability and organic fuel economy; solving problems of local energy and water supply; increasing the standard of living and level of employment of the local population; ensuring sustainable development of the remote regions in the desert and mountain zones; implementation of the obligations of the countries with regard to fulfilling the international agreements relating to environmental protection, will be stabilized [26]. Expansion and implementations of renewable energy projects in rural areas can create job opportunities and thus reducing migration towards urban areas [27]. Harvesting the renewable energy in reorganized manner is one of the options to meet the rural and small-scale energy needs in a consistent, affordable and ecologically sustainable way [28, 29].

Table 3: Main renewable energy sources and their usage form [21].

Energy source	Energy conversion and usage options
Hydropower	Power generation
Modern biomass	Heat and power generation, pyrolysis, gasification, digestion
Geothermal	Urban heating, power generation, hydrothermal, hot dry rock
Solar	Solar home system, solar dryers, solar cookers
Direct solar	Photovoltaic, thermal power generation, water heaters
Wind	Power generation, wind generators, wind mills, water pumps
Wave	Numerous designs
Tidal	Barrage, tidal system

5.2 Global renewable energy scenario

The present and future status of global renewable energy scenario is presented in table 4 [30].As we can see that in future almost 47.7 % of energy will be contributed by renewable sources reducing the burden on natural nonrenewable resources.

Table 4: Present and future global renewable energy scenario by 2040 [30]

Renewable Energy	Year			
	2010	2020	2030	2040
Biomass	1313	1791	2483	3271
Large hydro	266	309	341	358
Geothermal	86	186	333	493
Small hydro	19	49	106	189
Wind	44	266	542	688
Solar thermal	15	66	244	480
Photovoltaic	2	24	221	784
Solar thermal electricity	0.4	3	16	68
Marine (tidal/wave/ocean)	0.1	0.4	3	20
Total renewable energy source	1,745.5	2,964.4	4289	6351
Total consumption (million tons oil equivalent)	10,549	11,425	12,352	13,310
Renewable energy source contribution(%)	16.6	23.6	34.7	47.7

5.3 Significance of Sustainable renewable energy

Sustainable renewable energy is a key enabler of sustainable development for all countries and all people. The adequate provision of energy services has become especially important for economic development since the industrial revolution. Providing energy amenities at affordable costs, in a secure and ecologically benign manner, and in conformity with the needs for social and economic development is an essential element for poverty eradication and sustainable development. Countries will not be able to achieve their development goals without full access to consistent and affordable modern sustainable energy amenities.

In addition, reliable energy amenities are a precondition for investments that bring about economic growth and social development. The availability of energy amenities is a robust factor determining investments in the industrial, transport, education, health and all other major sectors of a country's economy leading to the development of human capital. The availability of sustainable renewable energy promotes equity and enhances opportunities facilitating empowering and improvement of the well-being of the population [4-8].

5.4 Major challenges associated to global energy systems

Major challenges associated to global energy systems comprise:

1. The need to provide access to affordable and reliable modern energy amenities for improving living conditions and health, and for enhancing economic opportunities for 2.8 billion people (about 40% of the world population) who use unsustainable solid fuels (including wood, agricultural waste and animal waste) primarily for cooking and heating and for 1.2 billion people who still live without access to electricity.
2. The need to satisfy rapid growth in energy demand for the well-being of over 7 billion people today and a projected world population of 9 billion by 2050. This is critical, particularly in developing countries and emerging economies where a large share of the population is moving towards higher economic strata demanding more and better energy amenities. This trend, in combination with the very high levels of energy being consumed today by many developed countries, is putting stress on global energy resources, forcing the world to look into energy efficiency measures and innovative ways to help us move towards a more optimal use of energy resources.
3. The need to reduce negative impacts associated with energy systems at the global, national and local levels. At the global level, energy and climate change are strongly related. Reducing greenhouse gases (GHG) emissions from energy systems is urgently needed to limit global warming to less than 2°C above pre-industrial levels. It is also urgent to decrease indoor and outdoor air pollution from fuel combustion and its impacts on human health and ecosystems, as well as to reduce other adverse effects and additional risks associated with some energy systems.

Therefore, a coordinated, sustained and comprehensive global energy strategy needs to be adopted, in conjunction with consistent and stable national policies, to be able to tackle these major challenges.

6. ECOLOGICAL VISION OF RENEWABLE ENERGY IN INDIA

6.1 Vision of production targets

World needs to harness its green potential to meet its growing power and ensure energy security. India will be among the top players in renewable energy as its target is: 200 GW renewable capacity by 2021-22 which is bifurcated as 100 GW Solar Capacity, 60 GW Wind Capacity and rest 40 GW by other means. Moreover, Solar Scale-up Plans for 100 GW Vision are by two categories as: Category 1 grid connected Rooftop Projects contributing 40 GW and Category 2 Large scale Projects contributing 60 GW of energy (Inside Solar park 20 GW, Outside Solar Park 40 GW) [31].

6.2 Illustrations of Ecological Vision

Ecovision at grassroot level [32]:

- Establishment of sensor electricity facility i.e. if someone walks out of the room then the lights are off automatically and vice versa.
- NTPC:Badarpur Thermal Power Station of NTPC in Delhi is devising ways to utilize coal-ash that has been a major source of air and water pollution.
- Kansai Nerolac has worked on removing hazardous heavy metals from their paints—among this lead being the most prominent metal. Kansai Nerolac does not add any lead or other such heavy metals in its manufacturing process.
- Dell has been one of the hawkers who focus on producing green IT products. They have a strategy called "Go green with Dell" to sell these goods in the market. It also comes in an eco-friendly packaging with a system recycling kit bundled along.
- Nike, shoe company to market itself, is marketing its Air Jordan shoes as environment-friendly, as it has significantly reduced the usage of harmful glue adhesives.
- In India we have Eco-hotels like Orchid, Rodas, Rain tree etc. believing and practicing green Marketing
- Barauni refinery is taken steps for restricting air and water pollutants
- The Taj chain, is in the process of creating eco rooms which have energy efficient mini bars, Organic bed linen and napkins made up of recycled papers
- Tuna manufacturers modified their fishing techniques because of the increased concern over driftnet fishing, and the resulting death of dolphins.
- Xerox introduced a high quality recycled photocopier paper in an attempt to satisfy the demands of firms for less environmentally harmful products.
- The Hewlett-Packard Company announced plans to deliver energy-efficient products and services and institute energy-efficient operating practices in its facilities worldwide.
- Eco shirts in Indian Market are introduced by Van Heusen.
- GE's eco-imagination initiative

7. CONCLUSION

Meeting the world's energy needs through the two proposed approaches: the first scenario in the long-term form of development is replacement of advanced Energy-productive technologies and/or implementation of hybrid processes instead of the conventional ones to reduce the fuel consumption and, afterwards, climate change; the second in the most sustainable form is the development of alternative energy resources, i.e. biomass, hydropower, wind, solar, geothermal and biofuels, are sustainable economically, socially and environmentally.

The three challenges of global energy systems would contribute towards the principal goal as supporting pillars. The comprehensive Global Tracking Framework (GTF)[33] provided by the World Bank, the International Energy Agency

(IEA) and 14 other organizations, states that "it is more practical to achieve all three mutually than it would be to pursue any one of them individually". These are compatible with the climate change target of keeping global temperature rise below 2°C as compared to pre-industrial levels, according to a study published by the journal Nature Climate Change: 'We find that achieving the three energy objectives could provide an important entry point to climate protection, and that sustainability and poverty eradication can go hand in hand with mitigating climate risks'[34]. Nevertheless, the ecovision towards a renewable energy remains as the best guideline that is proposed for sustainable development throughout the world.

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